AMERICAN NATIONAL STANDARD

ANSI/ISA-5.1-2009

Instrumentation Symbols and Identification

Approved 18 September 2009

ANSI/ISA-5.1-2009, Instrumentation Symbols and Identification

ISBN: 978-1-936007-29-5

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Preface (informative)

This preface is included for information purposes and is not part of ANSI/ISA-5.1-2009.

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THE USER OF THIS STANDARD SHOULD BE AWARE THAT THIS STANDARD MIGHT BE AFFECTED BY ELECTRONIC SECURITY ISSUES. THE COMMITTEE HAS NOT ADDRESSED THE POTENTIAL ISSUES IN THIS VERSION.

Users may find the following book of value in applying ANSI/ISA-5.1-2009:

> *Control System Documentation: Applying Symbols and Identification*, Thomas McAvinew www.isa.org/books.

Users of this standard are asked to send comments or suggestions to standards@isa.org.

The following served as voting members of the ISA5 Committee during development of ANSI/ISA 5.1-2009.

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On behalf of the ISA5 Committee and the ISA Standards & Practices Board, we wish to recognize and thank James Carew for his outstanding work, technical expertise, and commitment in leading the revision of this widely used ISA standard, and Thomas McAvinew for his valuable technical and editorial contributions.

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The ISA Standards and Practices Board approved this standard on 23 July 2009

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Contents

Introduction (informative)

(1) This introduction, as well as any footnotes, endnotes, and informative annexes, is included for information purposes and as background on the evolution of this standard and not as a normative part of ANSI/ISA-5.1-2009.

(2) The instrumentation symbolism and identification systems described in this standard accommodate advances in technology and reflect the collective industrial experience gained since the original ISA Recommended Practice RP-5.1, published in 1949, was revised, affirmed, and subsequently published as ANSI/ISA-5.1-1984, and then reaffirmed in 1992.

(3) This 2009 version attempts to strengthen this standard in its role as a communication tool in all industries that depend on measurement and control systems to operate and safeguard their manufacturing processes, machines, and other equipment. Communication presupposes and is facilitated by a common language. This 2009 version of the standard continues to build on the foundation for that common language.

(4) When integrated into a system, the designations and symbols presented here form a dedicated language that communicates concepts, facts, intent, instructions, and knowledge about measurement and control systems in all industries.

(5) The 1949 recommended practice and the 1984 standard were published as non-mandatory rather than as mandatory consensus documents. As such, they had many of the strengths and the weaknesses of such standards. Their primary strength was that they could be used in widespread, interdisciplinary ways. Their main weakness was that they were not specific enough, in some cases, to satisfy the special requirements of particular interest groups.

(6) This revision is published as a consensus standard and contains both mandatory and non-mandatory statements that have been reviewed and approved by a large group of practitioners in the field of instrumentation and control. This group was well versed in the use of identification and symbol systems as a means of communicating the intent of measurement and control systems to all that need such information. It is hoped that the consensus reached by this group regarding what is mandatory and what is not will enhance the strengths and lessen the weaknesses of the previous issues.

(7) Versions of this standard have been in use for more than fifty years, and most of the identification letter and symbol meanings or definitions that were contained in ISA-RP5.1-1949 and ISA-5.1-1984 (R 1992), have taken on a proprietary nature and have become accepted industry practice and assumed to be mandatory. The meanings and definitions of new symbols will be mandatory. This action is being taken in response to questions and comments that occur frequently because of unclear definitions.

(8) Mandatory definitions of meanings for letters used in identification and for symbols used in graphic depiction of measurement and control devices and functions are given. Mandatory minimum symbol dimensions are given. Informative identification and graphic symbol guidelines include alternate identification and symbol definitions and usage methods. Consistency is the one criterion that should govern the selection and application of identification and graphic schemes.

(9) This standard has been viewed in the past as being oriented to the oil and chemical process industries. This perception, while not intended, resulted from the fact that people who wrote the original and previous revisions were mainly working in those industries. It is the intent of the ISA5 committee that ISA Technical Reports will be used to address this type of problem. It is hoped that the technical report format will be specific enough to satisfy the special requirements of particular interest groups by providing examples and guidelines for use of the identification and symbolization methods for specific industries. These industries include, but are not limited to, metal refining, power generation, pulp and paper, and discrete parts manufacturing. The technical report format presents the best approach for making this standard applicable to industries that may have many usages and accepted practices that are not used in

the process industries.

(10) The extensive examples in previous versions of this standard that illustrated identification and symbolization definitions and methods have been removed and will be moved to technical reports that will be prepared after publication of this revised standard.

(11) The symbols and identification methods contained in this standard have evolved by the consensus method and are intended for wide application throughout all industries. The symbols and designations are used as conceptualizing aids, as design tools, as teaching devices, and as a concise and specific means of communication in **all types and kinds** of technical, engineering, procurement, construction, and maintenance documents, and not just piping and instrumentation diagrams (P&IDs).

(12) Previous versions of this standard have been flexible enough to serve all of the uses just described, and it must continue to do so into the future. To this end, this revision clarifies the definitions of symbols, identification, and definitions for concepts that were previously described, such as, for example, shared display/control, distributed control, and programmable control. It also adds definitions for new symbols required for functional diagramming of instruments and simple electrical circuit diagrams.

(13) This revision extensively changes the format of ANSI/ISA-5.1-1984 (R 1992). Clauses 1, 2, and 3 are essentially the same as previously written with some additions and modifications. Clauses 4, 5 and 6 and informative Annexes A and B are new or extensively revised.

(14) Clause 4, "Identification letter tables," was previously Clause 5, "Tables." It is almost the same as the previous version and deals only with Table 4.1, "Identification letters," which was previously Table 1, "Identification letters."

(15) Clause 5, "Graphic symbol tables," is a new clause that contains new symbols and the symbols that were previously in Clause 6, "Drawings," presented in a tabular format that includes text describing the application of the symbols but no examples of their use.

(16) Clause 6, "Graphic symbol dimension tables," is a new clause that establishes minimum mandatory dimensions for the symbols shown in the tables in Clause 5 when used in the preparation of full-size engineering drawings.

(17) Annex A, "Identification system guidelines (Informative)," was previously Clause 4, "Outline of the Identification System," and presents the most commonly used instrumentation and function identification methods. Included are expanded "Allowable loop and function letter combination" tables and added "Allowable loop letter scheme" tables.

(18) Annex B, "Graphic symbol guidelines" (Informative), is a new informative clause that replaces the examples formerly given in Clause 6, "Drawings," to provide some limited assistance in the application of the symbols in Clause 5.

(19) Definitions for identification letters and symbols are now mandatory to reduce the confusion caused by giving meanings to identification and symbols not intended by this standard. At the same time, the number of symbology and tagging bubbles required to depict a measurement or control scheme was allowed to range from "everything must be shown" to the "minimum required to convey the instrumentation and functionality required." Guidelines are intended to aid in the application of identification and symbology and to include some of the known methods as alternate usages.

(20) The meanings of 'shared display, shared control,' and 'programmable logic control' have been clarified and expanded because of changes in technology and usage since their inception in ISA-5.3-1983, "Graphic Symbols for Distributed Control/Shared Display Instrumentation, Logic and Computer Systems." The commonly assumed meanings of 'circle-in-square' as distributed control system (DCS) functions and of 'diamond-in-square' as programmable logic controller (PLC) functions are no longer

accurate because they no longer reflect the currently acceptable meanings. DCSs and PLCs can both perform continuous and binary control functions. The same functions are performed by personal computers (PC) and by fieldbus and devicebus devices. Both 'circle-in-square' and 'diamond-in-square' symbols are classified as 'shared display, shared control.' 'Circle-in-square' will depict either (a) primary control system choice or (b) basic process control system (BPCS). 'Diamond-in-square' will depict either (a) alternate control system choice or (b) safety instrumented system (SIS). Users who continue to use the symbols as in the past should change to the revised meanings as soon as possible.

(21) This revision uses, with permission, information from the excellent SAMA (Scientific Apparatus Makers Association) PMC 22.1-1981, "Functional Diagramming of Instrument and Control Systems," a document still used by many control system engineers and designers. SAMA symbols and descriptions for functional diagramming of Instruments and control loops and for signal processing symbols and function blocks were adapted in ANSI/ISA-5.1-1984 (R 1992) for use in loop schematic diagrams. This revision adds the SAMA symbols and descriptions for logic function enclosures for use in functional diagrams, logic diagrams, and application software functions. Guidelines for a limited number of applications of the symbols will be found in Annex B, "Graphic symbol system guidelines (Informative)."

(22) The binary line symbols, which were introduced in ANSI/ISA-5.1-1984 (R 1992) to aid the batch processing industries, have been removed because of their general lack of use and acceptance and the many objections to their use. If their use is desired within the batch processing industries, an ISA Technical Report could be produced to cover this unique need.

(23) The many examples contained in Clause 6 of ANSI/ISA-5.1-1984 (R 1992) have been reduced in number and are now located in Annex B. It is hoped that ISA Technical Reports will be prepared based on this standard to cover the application of identification and symbolization methods and practices in the detail required by users in those many industries beyond the process industries, who depend on this standard in their daily work.

(24) The ISA5 committee and ISA5.1 subcommittee recognize and deeply appreciate the work of previous ISA5.1 subcommittees, and have tried to treat their work with the great respect it deserves.

(25) ISA5 and ISA5.1 also acknowledge the work done by the past ISA5.2 and ISA5.3 subcommittees in developing ISA-5.2-1976 (R1992), "Binary Logic Diagrams for Process Operations," and ISA-5.3-1983, "Graphic Symbols for Distributed Control/Shared Display Instrumentation, Logic and Computer Systems." The key elements of ISA-5.3-1983 were incorporated in ANSI/ISA-5.1-1984 (R 1992) and have been expanded in this revision. The key elements of ISA-5.2-1976 are incorporated and integrated with the logic symbols from SAMA PMC 22.1-1981 for symbolizing and describing binary functions. Guidelines for the application of the binary system can be found in Annex B (Informative), Graphic symbol system guidelines.

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1 Purpose

This standard establishes a uniform means of depicting and identifying instruments or devices and their inherent functions, instrumentation systems and functions, and application software functions used for measurement, monitoring, and control, by presenting a designation system that includes identification schemes and graphic symbols.

2 Scope

2.1 General

2.1.1 This standard is intended to meet the different procedures of various users who need to identify and graphically depict measurement and control equipment and systems. These differences are recognized when they are consistent with the objectives of this standard, by providing alternative symbol and identification methods.

2.1.2 A limited number of examples are provided that illustrate how to:

a) Design an identification system and construct an identification number.

b) Use graphic symbols to construct:

1) Instrumentation schematic diagrams of the instruments, devices, and functions required for monitoring and control loops.

2) Functional diagrams of instruments, loops, and application software functions.

3) Binary logic diagrams.

4) Ladder diagrams of electrical circuits.

c) Add information and simplify diagrams.

2.1.3 Examples of identification and symbol applications are intended to illustrate basic concepts in the construction of the identification systems and diagrams covered by this standard that are applicable to all user industries.

2.2 Application to industries

2.2.1 This standard is suitable for use in the chemical, petroleum, power generation, metal refining, pulp and paper, and numerous other continuous, batch, discrete-part processing, and material-handling industries. These industries and others require the use of control system schematics, functional diagrams, and electrical schematics to describe the relationship to processing equipment and the functionality of measurement and control equipment.